DOCUMENT RESUME

ED 277 747 TM 870 026

TITLE	Mathematics, Grade 9. TEAMS Instructional Strategies Guide.
INSTITUTION	Texas Education Agency, Austin.
PUB DATE	Aug 86
NOTE	68p.; For related documents, see TM 870 022-039.
AVAILABLE FROM	Texas Education Agency, William B. Travis Building, 1701 North Congress Avenue, Austin, TX 78701.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Algebra; Basic Skills; *Behavioral Objectives; Computation; Geometry; *Grade 9; High Schools; Instructional Development; Learning Activities; *Learning Strategies; *Mathematics Instruction; Mathematics Skills; *Mathematics Tests; *Minimum Competency Testing; Number Concepts; Probability; Problem Solving; Secondary School Mathematics; State Programs; Teaching Guides; Testing Programs; Test Items
IDENTIFIERS	Test Content; *Texas Educational Assessment of Minimum Skills

ABSTRACT

The Texas Educational Assessement of Minimum Skills (TEAMS) was developed by the Texas Education Agency (TEA), in response to Texas House Bill 72 (1984), which mandated as new basic skills assessment program for mathematics, reading, and writing at grades 1, 3, 5, 7, 9 and 11. This is one in a series of Instructional Strategies Guides designed to familiarize Texas educators with the types of strategies employed in assessing learner mastery of TEAMS objectives and to provide suggested instructional activities that can be used to promote mastery of those objectives. This guide focuses on the TEAMS mathematics objectives for grade 9. It provides detailed description of the test items used to measure each mathematics objective. The 11 objectives are subsumed under seven skill areas: (1) number concepts (decimals, fractions, percents); (2) computation (addition and subtraction of fractions, multiplication and division of decimals); (3) problem solving (basic operations, ratios, proportions, percents, personal finance); (4) measurement (metric and customary measurements); (5) geometry (area of rectangles and triangles); (6) probability, statistics, and graphing (simple probabilities, charts and graphs); and (7) algebraic concepts (formulas). The following information is provided for each objective: (1) a description of the objective; (2) a sample item; (3) test questions; (4) answer choices; (5) answer analysis of the sample item; (6) instructional emphases; and (7) possible instructional activities. (JAZ)

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INSTRUCTIONAL STRATEGIES GUIDE

MATHEMATICS

GRADE 9

TEXAS EDUCATION AGENCY
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TEAMS INSTRUCTIONAL STRATEGIES GUIDE

MATHEMATICS

GRADE 9

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TABLE OF CONTENTS

	Page
Acknowledgments	ii
Introduction	1
Components of the Instructional Strategies Guide	1
Use of the Instructional Strategies Guide	3
General Nature of the Test Items	3
Skill Area: Number Concepts	
Objective 1: Identify the relationship between decimals, fractions, and percents.	4
Skill Area: Computation	
Objective 2: Add and subtract fractions.	9
Objective 3: Multiply and divide decimals.	15
Skill Area: Problem Solving	
Objective 4: Solve two- and three-step word problems using the basic operations.	20
Objective 5: Solve word problems using ratios, proportions, and percents.	26
Objective 6: Solve personal finance problems.	32
Skill Area: Measurement	
Objective 7: Solve word problems involving metric/customary measurements using the basic operations.	36
Skill Area: Geometry	
Objective 8: Find the areas of rectangles and triangles.	42
Skill Area: Probability, Statistics, and Graphing	
Objective 9: Determine simple probabilities.	47
Objective 10: Use information from charts or graphs to solve word problems.	51
Skill Area: Algebraic Concepts	
Objective 11: Use formulas to solve problems.	59

ACKNOWLEDGMENTS

Under contract with the Texas Education Agency, the Information Services Division of National Computer Systems subcontracted with IOX Assessment Associates to develop this TEAMS instructional strategies guide.

Key reviewers of early drafts of the guide were Lisa Chandler, Norlene M. Kunkel, Barbara Montalto, Cathy Seeley Peavler, and Patricia Sachse Porter of the Texas Education Agency.

INTRODUCTION

During 1980-1985 the Texas Education Agency (TEA) administered a criterion-referenced testing program, the Texas Assessment of Basic Skills (TABS). That program was designed to measure minimum skills in mathematics, reading, and writing at Grades 3, 5, and 9. In July 1984, under the provisions of House Bill 72, a new basic skills assessment program was mandated in mathematics, reading, and writing at Grades 1, 3, 5, 7, 9, and 11. In response, development of the Texas Educational Assessment of Minimum Skills (TEAMS) was instituted by TEA during the 1985-1986 school year.

School district personnel from across Texas participated in all aspects of the development of TEAMS. Basic skills objectives were selected after a thorough review of the State Board of Education Rules for Curriculum, GE4 450 01 (Essential Elements). Under TEA supervision measurement specifications and test items were developed for each objective. Statewide field testing was conducted to ensure the quality of test items. The State Board of Education then approved the TEAMS tests for administration.

Because of the significance of the TEAMS program, TEA is providing Texas educators with instructional strategies guides for all objectives measured on each TEAMS examination. These guides describe the TEAMS objectives as well as instructional considerations and activities that can be used to promote mastery of TEAMS objectives.

This instructional strategies guide focuses on the TEAMS mathematics objectives for Grade 9. It provides a detailed description of the test items used to measure each mathematics objective. In addition, a brief instructional analysis is provided for each objective as are instructional activities that can help students master the objective.

Texas educators will undoubtedly vary in the ways they wish to promote learner mastery of the TEAMS objectives. Thus, the instructional components of this guide are <u>not</u> intended to be prescriptive. Teachers should view suggested activities as potential approaches that lead to mastery of the TEAMS objectives.

Components of the Instructional Strategies Guide

Eleven TEAMS mathematics objectives are measured at the ninth grade level. These objectives are subsumed under one of seven skill areas. The distribution of mathematics objectives by skill area is shown on the next page.

SKILL AREA	OBJECTIVE
Number Concepts	Decimals, Fractions, and Percents
Computation	Addition and Subtraction of Fractions Multiplication and Division of Decimals
Problem Solving	Basic Operations Ratios, Proportions, and Percents Personal Finance
Measurement	Metric and Customary Measurements
Geometry	Area of Rectangles and Triangles
Probability, Statistics, and Graphing	Simple Probabilities Charts and Graphs
Algebraic Concepts	Formulas

This guide provides the following information for each of the mathematics objectives included in the TEAMS Grade 9 test.

Description of the objective. This section provides a succinct overview of the objective's focus.

Sample item. An illustrative sample item follows the description of each objective. This item is consistent with the test specifications for the objective, hence is representative of the TEAMS items used to measure students' mastery of the objective.

Test questions. To provide a more detailed view of how each TEAMS objective is assessed, the next section provides a description of the test question. All of the Grade 9 mathematics items present a stimulus that precedes four answer choices.

Answer choices. The next section deals with the response to each multiple-choice test item. Important characteristics of the answer choices are described.

Answer analysis for sample item. An analysis of the answer choices from the sample item is then provided. This analysis explains why the correct answer is right and why the incorrect answers are wrong.

Instructional emphases. Considerations relevant to the design of instructional sequences for each TEAMS objective are described in this section. These instructional analyses are not intended to represent the only important points associated with instruction aimed at a particular objective. However, it is hoped that these discussions will stimulate educators' consideration of each objective.

Possible instructional activities. A final section discusses several instructional activities for each objective that Texas educators may consider as they organize their instructional plans.

Use of the Instructional Strategies Guide

This TEAMS instructional strategies guide is designed to accomplish two goals. First, the guide enables Texas educators to become familiar with the types of strategies employed to assess learner mastery of the TEAMS Grade 9 mathematics objectives. Educators who wish to learn more about how the TEAMS objectives are tested should consult the TEAMS objectives and measurement specifications available at cost from TEA. The level of detail provided in this instructional strategies guide should provide sufficient information for educators to design effective instructional sequences. Second, each instructional strategies guide provides suggestions for instructional activities that can be used to promote mastery of TEAMS objectives.

The specific setting in which a given district chooses to provide instruction in the TEAMS objectives will influence the way in which the materials in this guide can be employed. The format of the guide permits flexible use.

General Nature of the Test Items

The TEAMS Grade 9 mathematics objectives are measured by multiple-choice items that present a problem followed by four answer choices, one of which is correct. The items, depending on the objective, present a graphic or tabular display, a geometric figure, a numeric problem, or a word problem. The problems are similar to those that students encounter in school, at home, or in their community.

SKILL AREA: NUMBER CONCEPTS

The skill area of number concepts consists of one objective that involves decimals, fractions, and percents.

Objective 1: Identify the relationship between decimals, fractions, and percents.

This objective requires students to identify equivalencies among fractions, decimals, and percents.

Sample Item

Change 40% to a fraction.

A. $\frac{1}{40}$

B. $\frac{1}{25}$

C. $\frac{1}{4}$

D. $\frac{2}{5}$

Test Questions

1. A test item will require students to carry out one of four possible conversions: (1) a decimal to an equivalent fraction, (2) a decimal to an equivalent percent, (3) a fraction to an equivalent percent, or (4) a percent to an equivalent fraction.

2. Fractions will be limited to halves, thirds, fourths, fifths, sixths, eighths, and tenths.

3. All fractions will be less than one.

4. Decimals will have a value less than one and will have no more than three digits. For items requiring students to change a decimal to a fraction, only one- or two-digit decimals will be used.

5. Percents will be expressed using the symbol (%) and will be whole numbers less than 100. Percents which contain decimals (for example, .25%) will be limited to a maximum of

three digits. For items requiring students to change a percent containing a decimal to a fraction, only one- or two-digit decimals will be used.

Answer Choices

1. Each answer choice will be either a fraction or a percent.

2. The correct answer choice will be the fraction or percent that is equivalent to the specified number.

3. Answer choices will not include fractions which are equivalent to each other.

4. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the addition, subtraction, multiplication, or division of two numbers.

   b. Incorrect Simplification: Incorrectly simplifying a fraction. This type of error will only appear as an incorrect answer choice for items directing the student to express a number as a fraction.

   c. Misplaced Decimal Point: Placing the decimal point in an incorrect position on either a correct solution or an incorrect solution. Decimal errors will only appear as incorrect answer choices for items directing the student to express a number as a decimal or percent.

   d. Reciprocal Error: Incorrectly identifying the reciprocal of a fraction as the fraction itself.

   e. Place Value Error: Failure to retain the place value of zero.

   f. Fractional Conversion Error: An error in converting a decimal or percent to a fraction, or vice versa.

Answer Analysis for Sample Item:

1. Answer choice A is incorrect due to a fractional conversion error. Rather than placing 40 over 100, 1 was placed over 40.

2. Answer choice B is incorrect due to a place value error. The place value for 0 was dropped, and the number 4 was used in the fraction instead of 40. The fraction $\frac{4}{100}$ was then simplified to $\frac{1}{25}$.

3. Answer choice C is also incorrect due to a fractional conversion error. Rather than setting up the problem as $\frac{40}{100}$, $\frac{1}{4}$ was used.

4. Answer choice D is the correct response. The fraction equivalent of 40% is $\frac{2}{5}$ because $\frac{40}{100}$ reduced to simplest terms equals $\frac{2}{5}$.

Instructional Emphases

After stressing the importance of knowing which conversion is called for, you may want to review the following rules for each type of conversion.

Converting Fractions to Percents

1. Convert the fraction to a decimal by dividing the denominator of the fraction into the numerator.
2. Multiply by 100 (move the decimal point two spaces to the right).
3. Add a percent sign.

Example: $\frac{1}{2}$ = what percent?

Step 1: $2\overline{)1.00}$ (.50; 1 0) Step 2: .5 0 Step 3: 50%

Converting Decimals to Fractions

1. Note the place value of the last digit in the decimal.
2. Drop the decimal point and place the entire number over the above-noted place value.
3. Simplify if possible.

Example: .25 = what fraction?

Step 1: .25 = hundredths Step 2: $\frac{25}{100}$ Step 3: $\frac{1}{4}$

Converting Decimals to Percents

1. Multiply by 100 (move the decimal point two places to the right).
2. Add a percent sign.

Example: .35 = what percent?

Step 1: .3 5 Step 2: 35%

Converting Percents to Fractions

1. Drop the percent sign.
2. Place the number over 100.
3. Simplify if possible.
   Example: 46% = what fraction?

   Step 1: 46% ---> 46 Step 2: $\frac{46}{100}$ Step 3: $\frac{23}{50}$

The following skills are necessary for students to master the objective of equivalencies:

1. Ability to recognize the form of <u>fractions</u> $\frac{A}{B}$, <u>decimals</u> .AB, and <u>percents</u> A.B%.

2. Ability to divide with a decimal number.

3. Ability to simplify fractions.

4. Ability to multiply and divide by 100.

If students are weak in any of these areas, they will have difficulty performing the conversions required in this objective. Be sure to provide instruction in these areas if students are having difficulty. It may also be helpful for students to memorize a few common conversions such as .25 = 1/4 = 25%. Students can then refer to these memorized relationships to determine the methods necessary to perform other, less common, conversions.

Possible Instructional Activities

Equivalence Relay

Divide students into two teams for a relay activity. Place two equivalence charts on the board, one for each team. Each equivalence chart should contain the following three column headings: Fraction in Simplest Form, Decimal, Percent. Use as many rows as you feel are necessary. Fill in one space per row with an appropriate number. Each team is to complete their chart by converting the number supplied in each row into the other two numbers required to complete the row. For example, if the decimal an equivalent percent in order to complete that row. Because students are not yet required to convert fractions or percents to decimals, you may want to place an X at appropriate points in the Decimal column. (You can, however, encourage students to solve these equivalencies as a challenge.) Have the members of each team take turns at filling in the team chart. The team that finishes first with the fewest errors wins.

Batter Up

Below is a list of statistics for seven players on an imaginary baseball team. Tell students that it is the beginning of the season and each statistic is based on the number of hits over the number of times at bat for this year. Statistics can be expressed as either fractions, decimals, or percents. Have students convert each statistic into either a fraction, decimal, or percent, as indicated. Fractions should be reduced to simplest terms.

Direct students to find their answers in the code key and write the letters in the spaces provided. If the problems are performed correctly, the letters should spell out the answer to the following baseball trivia question: Where was the first all-star baseball game held?

1. Steve: $\frac{4}{5}$ percent = _____
2. Aida: .05 fraction = _____
3. Gary: $\frac{1}{5}$ percent = _____
4. Trina: .80 percent = _____
5. Rosa: .60 fraction = _____
6. Tom: $\frac{3}{4}$ percent = _____
7. Rene: 25% fraction = _____

A	B	C	F	G	H	I	O	P	Q
$\frac{3}{5}$	30%	80%	$\frac{4}{5}$	375%	$\frac{1}{20}$	20%	$\frac{1}{4}$	$\frac{1}{25}$	$\frac{1}{6}$

_____ _____ _____ _____ _____ _____ _____

1 2 3 4 5 6 7

You Pay Less

Divide the class into several small groups of "retailers" and "consumers." Provide the retailers with a consumer product and its regular price. For example, you may specify that a radio regularly priced at $40.00 by each retailer group is now on sale. Each retailer group then makes their sales claim in terms of a decimal, fraction, or percentage of the regular price (for example, .10 off, $\frac{1}{3}$ less, 15% discount). The consumer groups must then decide which retailer group has the best price. Repeat this process with a few products, then have the groups reverse roles.

SKILL AREA: COMPUTATION

The skill area of computation covers two objectives, specifically, fractions and decimals. For each objective, students will be presented with computation problems which are described below.

Objective 2: Add and subtract fractions.

This objective requires students to add or subtract fractions and mixed numbers.

Sample Item

$$\frac{13}{20} - \frac{1}{4} = ____.$$

A. $\frac{7}{20}$

B. $\frac{2}{5}$

C. $\frac{1}{3}$

D. $\frac{3}{5}$

Test Questions

1. A test item will require students to add or subtract fractions and mixed numbers.

2. The value of a fraction or mixed number will be positive and will not exceed 10. Denominators and common denominators will not be larger than 25.

Answer Choices

1. Fractions and mixed numbers will be expressed in lowest terms. For example, $\frac{10}{3}$ and $3\frac{1}{3}$ are both in lowest terms.

2. Some answers greater than one will be expressed as mixed numbers, and some will be expressed as fractions. However, both forms will not appear in the same problem.

3. The correct answer choice will be the exact solution to the addition or subtraction problem presented.

4. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the addition or subtraction of two numbers.

   b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   c. Common Denominator Error: An error in selecting the lowest common denominator or in renaming fractions in terms of the lowest common denominator.

   d. Incorrect Simplification: Incorrectly simplifying a fraction.

   e. Incorrect Operation: Performing an operation other than the required one.

Answer Analysis for Sample Item

1. Answer choice A is incorrect because of a computation error. The subtrahend, $\frac{1}{4}$, was correctly converted to $\frac{5}{20}$. However, $\frac{5}{20}$ was then incorrectly subtracted from $\frac{13}{20}$ to obtain $\frac{7}{20}$.

2. Answer choice B is the correct response, as illustrated below. The subtrahend, $\frac{1}{4}$, was correctly converted to $\frac{5}{20}$ before subtraction. The solution, $\frac{8}{20}$, was then correctly simplified to obtain $\frac{2}{5}$.

$$\frac{13}{20} - \frac{1}{4} = \frac{13}{20} - (\frac{1}{4} \times \frac{5}{5}) = \frac{13}{20} - \frac{5}{20} = \frac{8}{20} = \frac{2}{5}$$

3. Answer choice C is incorrect because $\frac{8}{20}$ was incorrectly simplified to $\frac{1}{3}$.

4. Answer choice D is incorrect because of a failure to rename the numerator of the second fraction in terms of the common denominator. The original numerator was not changed, and subsequent subtraction ($\frac{13}{20} - \frac{1}{20}$) yielded the incorrect answer $\frac{12}{20}$. This answer was then simplified to $\frac{3}{5}$.

Instructional Emphases

The problems under this objective require students to add and subtract fractions and express the answer in lowest terms. Students must learn the steps involved in these operations, including computation with mixed numbers, finding a common denominator, and expressing fractions in terms of that denominator.

Show students that any fraction with a value greater than one can be expressed either as a fraction or as a mixed number. To express a fraction greater than one as a mixed number, simply divide the numerator into the denominator. If any number remains, this number becomes the numerator of the fraction part of the mixed number. The denominator of the fraction part of the mixed number remains unchanged. For example:

$$\frac{5}{3} = \begin{array}{r} 1 \text{ R } 2 \\ 3\overline{)5} \\ \underline{3} \\ 2 \end{array} = 1\frac{2}{3}$$

When adding or subtracting fractions and mixed numbers, it is important for students to remember that the common denominator is neither added nor subtracted, but is used as the denominator in the answer. Remind students to express their answers in lowest terms. Presented below are the steps necessary to add and subtract fractions and mixed numbers. You may want to review these steps with students as you work through some examples.

1. Check the denominators of each number to be added or subtracted. Are they the same? If so, proceed to Step 4; if not, proceed to Step 2.

2. If the denominators are not the same, find the lowest common denominator (LCD). The LCD is the lowest multiple that is common to both denominators. Thus, to find the LCD of two fractions, list the multiples of the two denominators until a common multiple is found. For example, given the fractions $\frac{1}{6}$ and $\frac{2}{9}$, the multiples of 6 and 9 are listed until a common multiple is identified.

   Multiples of 6: 6, 12, (18)
   Multiples of 9: 9, (18)

   The common multiple 18 is the LCD of the two fractions $\frac{1}{6}$ and $\frac{2}{9}$.

3. Obtain equivalent fractions by multiplying each numerator by the same factor that was used to obtain the new denominator. For example:

$\frac{1}{6} = \frac{?}{18}$ ----> $\frac{1}{6} \times \frac{(3)}{(3)} = \frac{3}{18}$

$\frac{2}{9} = \frac{?}{18}$ ----> $\frac{2}{9} \times \frac{(2)}{(2)} = \frac{4}{18}$

4. Perform the addition or subtraction operation, keeping the denominator the same. For mixed numbers, operate on the fraction parts before the whole numbers.

5. If possible, simplify the resulting fraction or rename the fraction as a mixed number.

Example 1: $4\frac{7}{8} + \frac{5}{8}$

Step 1: denominators are the same

Step 4:

$$\begin{array}{r} 4\ \frac{7}{8} \\ +\ \frac{5}{8} \\ \hline 4\ \frac{12}{8} \end{array}$$

Step 5: $\frac{12}{8} = 12 \div 8 = 1\ \frac{4}{8}$; $4 + 1\ \frac{4}{8} = 5\ \frac{4}{8} = 5\ \frac{1}{2}$

Example 2: $\frac{3}{8} - \frac{1}{6}$

Step 1: denominators are <u>not</u> the same

Step 2: multiples of 6: 6, 12, 18, (24)
multiples of 8: 8, 16, (24)
LCD = 24

Step 3: $\frac{3}{8} = \frac{9}{24}$ and $\frac{1}{6} = \frac{4}{24}$

Step 4:

$$\begin{array}{r} \frac{9}{24} \\ -\ \frac{4}{24} \\ \hline \frac{5}{24} \end{array}$$

Step 5: $\frac{5}{24}$ cannot be simplified

Possible Instructional Activities

Spinning Fractions

Divide the class into small groups and provide each group of students with a spinner that has the numbers 1 through 6. Within groups, students take turns spinning the spinner to create fractions for a computation problem. Each student spins the spinner four times. The first two spins determine the value of the first fraction, and the last two spins determine the value of the second fraction. If the second fraction is larger than the first, the two fractions must be added. If the second fraction is smaller than the first, the second fraction is subtracted from the first. For example, suppose a given student obtained the numbers 6, 3, 2, 4 on the four spins. The fractions created are $\frac{6}{3}$ and $\frac{2}{4}$. The problem that the student must solve is $\frac{6}{3} - \frac{2}{4}$ because the second fraction is smaller than the first.

After a student has made four spins, the spinner is given to the next student. Have the students continue passing the spinner and creating fractions until each student has done several computations.

Fraction Construction

Write the following problems on the board, with the numbers in parentheses presented to the right of each problem.

$\frac{\square}{\square} + \frac{\square}{6} = ____$ (3,4,2)

$\frac{12}{\square} - \frac{\square}{\square} = ____$ (3,4,6)

$\frac{\square}{\square} + \frac{1}{\square} = ____$ (2,5,10)

$\frac{9}{\square} - \frac{\square}{\square} = ____$ (1,2,3)

$\frac{\square}{3} + \frac{\square}{\square} = ____$ (2,8,12)

$\frac{10}{\square} - \frac{\square}{\square} = ____$ (2,3,4)

Tell students to complete each problem by placing a number in each box from the set of numbers listed in parentheses. Each number in a list should be used to fill one box only. Suggest that students try to place the numbers so that their answer will be the largest or smallest solution to the problem. Students should solve the problems they design and simplify the answers. When everyone has finished the problems, ask for the largest or smallest answer possible for each problem. Call on students to demonstrate such solutions on the board.

Fraction Fill-in

Present students with a list of three fractions and/or mixed numbers. Below these numbers, write three operations with one number missing, as shown in the example provided below.

$\frac{1}{2}, \frac{5}{6}, \frac{1}{4}$

$\square + \frac{2}{3} = 1\frac{1}{2}$

$2\frac{3}{4} - \square = 2\frac{1}{2}$

$\frac{3}{10} + \frac{1}{5} = \square$

Students are to complete the operations by filling in each box with a fraction or mixed number from the preceding list. All numbers are to be used only once. Create similar problem sets as needed.

Objective 3: Multiply and divide decimals.

This objective requires students to solve multiplication and division problems involving decimal numbers.

Sample Item

6.15 x 2.8 =

A. 15.22

B. 17.22

C. 6.15

D. 162.2

Test Questions

1. For multiplication items, numbers will not be larger than a three-digit number multiplied by a two-digit number. For division items, numbers will not be larger than a four-digit number divided by a two-digit number. At least one number in each item will be a decimal number.

2. Multiplication items will be presented either vertically or horizontally. Division items will be presented in the form $X \div Y$ or $Y\overline{)X}$.

Answer Choices

1. The correct answer choice will be the exact solution to the multiplication or division problem presented.

2. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the multiplication or division of two numbers.

   b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   c. Misplaced Decimal Point: Placing the decimal point in an incorrect position on either a correct solution or an incorrect solution.

   d. Misaligned Digit: Misaligning partial products.

   e. Switched Operand: Reversal of the divisor and dividend. This type of error will only appear in an incorrect answer choice for division items.

Answer Analysis for Sample Item

1. Answer choice A is incorrect because of a computation error, as illustrated. The second partial product should be 1230, not 1030. An error was made in multiplying 6 by 2 to obtain 10, instead of 12. The error in the partial product yields the error in the final product.

```
          6.15
        x 2.8
          4920
(error)  1030
         15.220
```

2. Answer choice B is the correct response, as illustrated. The multiplication is accurate, the digits are correctly aligned, and the decimal is properly placed.

```
          6.15
        x 2.8
          4920
         1230
         17.220
```

3. Answer choice C is incorrect because the digits were misaligned, as illustrated. Space for a "place holder" zero is needed in the far right position of the second partial product.

```
          6.15
        x 2.8
          4920
(error)   1230
          6.150
```

4. Answer choice D is incorrect because there is a regrouping error and a misplaced decimal point, as illustrated. The regrouping error occurred when the two partial products were added. Specifically, regrouping was required but not performed in the tens place. Furthermore the decimal point is inaccurately placed in the final product.

```
          6.15
        x 2.8
          4920
         1230
(error)  162.20
```

Instructional Emphases

This objective requires students to use one of two operations to solve problems involving decimals. Once students have identified the appropriate operation, they can proceed with the necessary computations. It may help students to be reminded

that computations for decimal operations are performed no differently from whole number operations. You may need to spend some time, however, reviewing the placement of the decimal point.

Students should realize that it is not necessary to align decimals when multiplying or dividing. When multiplying, the number of places to the right of the decimal in the product should be the same as the sum of the number of places to the right of the decimal in the factors. In division, divisors should be converted from decimals to whole numbers. The decimal point in the dividend must be moved to the right the same number of places that it is moved in the divisor.

The steps required for the two types of decimal operations are presented below. Students may find a review of these steps helpful.

Multiplying with Decimals

1. Write the problem in vertical format. Align digits on the far right, as in whole number operations.

2. Multiply as with whole numbers.

3. Place the decimal point in the answer such that the number of places to the right of the decimal is equal to the sum of the number of places to the right of the decimals in the numbers being multiplied.

Example: 7.26 x .3

Step 1:
$$\begin{array}{r} 7.26 \\ \times\ .3 \\ \hline \end{array}$$

Step 2:
$$\begin{array}{rl} 7.26 & (2 \text{ places}) \\ \times\ .3 & (1 \text{ place}) \\ \hline 2178 & \end{array}$$

Step 3: 2.178 (2 + 1, or 3 places to the right of the decimal)

Dividing with Decimals

1. The divisor should be a whole number. Move the decimal point in the divisor to the right as many places as necessary. Move the decimal point in the dividend to the right the same number of places. Add zeros in the dividend as needed.

2. Divide.

3. Place the decimal point in the quotient directly above the decimal point in the dividend.

Example: $.16\overline{)25.6}$

Step 1: $16.\overline{)2560.}$

Step 2:
$$\begin{array}{r} 160 \\ 16\overline{)2560} \\ \underline{16} \\ 96 \\ \underline{96} \\ 0 \end{array}$$

Step 3:
$$\begin{array}{r} 160 \\ 16\overline{)2560} \end{array}$$

Possible Instructional Activities

Give Me a Point

Write the following "letter" problems on the chalkboard. Have different students demonstrate where to insert the decimal point in the answer.

$$\begin{array}{r} A.BC \\ \times\ \ EF \\ \hline GHIJK \end{array} \qquad \begin{array}{r} ABC \\ \times\ .D \\ \hline EFGH \end{array} \qquad \begin{array}{r} .ABC \\ \times\ \ DE \\ \hline GHIJK \end{array}$$

$$\begin{array}{r} E \\ .AB\overline{)}.CD \end{array} \qquad \begin{array}{r} F \\ AB\overline{)}CD.E \end{array} \qquad \begin{array}{r} GH \\ A.B\overline{)}CD.EF \end{array}$$

Cruising

Below is a chart showing cost and amount of gas used by ten people for a single week. There is one piece of information missing for each person. Copy this chart and distribute it to students. Tell students to use the information presented on each line to solve for the missing information.

Record of Gas Costs Over One Week for 10 People

Person	Price Per Gallon of Gas	Number of Gallons Used	Total Cost
Mary	$0.99	10.0	$ 9.90
Joshua	$0.90	_____	$13.95
Darren	$0.95	_____	$ 8.17
Deanna	$1.23	26	_____
Candy	$0.96	18.5	_____
Krista	$_____	16.4	$14.76
Isabelle	$_____	7.7	$ 7.70
Reynaldo	$0.98	_____	$10.78
Miko	$1.15	4.6	_____
Justin	$1.09	6.0	_____

Extra, Extra, Read All About It

Have students bring in magazine or newspaper subscription information. Tell students to be prepared to discuss the number of issues in a 6-month, 1-year, and 2-year subscription as well as the subscription prices. Write the subscription information on the board, and have students divide to compute the subscription price per issue. (You may want to point out that this amount is almost always less than the single issue newsstand price.) Students may wish to bring in other information that is appropriate for this type of activity (for example, by bringing in the total cost of a product in various sizes students can compare the cost per ounce).

SKILL AREA: PROBLEM SOLVING

The skill area of problem solving covers three objectives involving multiple operations, proportions, and personal finance. Students will be presented with word problems for each of these objectives.

Objective 4: Solve two- and three-step word problems using the basic operations.

This objective requires students to solve two- and three-step word problems with whole numbers using the basic operations.

Sample Item

The distance from Gary's house to the nearest beach is 132 miles. He makes a round trip once each month. How many miles does he travel in 6 months going to and from the beach?

A. 396 miles

B. 1564 miles

C. 1584 miles

D. 792 miles

Test Questions

1. A test item will present a word problem that requires either two or three operations to solve. The eligible operations are addition, subtraction, multiplication, and division.

2. The numbers used will be whole numbers no larger than three digits. Some items will involve the use of money in whole dollar amounts.

3. Division problems will not result in remainders.

Answer Choices

1. The correct answer will be the exact solution to the problem presented.

2. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the addition, subtraction, multiplication, or division of two numbers.

b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping when unnecessary.

c. Incorrect Operation: Performing an operation other than the required one.

d. Missing Operation: Not operating on the data or omitting one of the required operations.

e. Incorrect Data Error: Performing a necessary operation on the wrong data.

f. Incorrect Order Operation: Performing the required operations, but in the wrong order.

Answer Analysis for Sample Item

1. Answer choice A is incorrect as the result of an incorrect operation. As shown, the number of miles to the beach was divided by 2 rather than multiplied by 2.

Step 1: (error: incorrect operation to obtain round-trip mileage)

$$2\overline{)132}$$ 66 miles

Step 2: (incorporates error in Step 1)

66 miles
x 6 trips
396 miles

2. Answer choice B is incorrect because of a regrouping error, as illustrated.

Step 1: (no error)

132 miles
x 2 trips
264 miles

Step 2: (error: failure to regroup to tens place)

264 miles
x 6 miles
1564 miles

3. Answer choice C is the correct response, as illustrated.

Step 1: (round trip mileage)

132 miles
x 2
264 miles

Step 2: (total mileage)

264 miles
x 6
1584 miles

4. Answer choice D is incorrect because of a missing operation. The total one-way mileage, 792 miles, is not multiplied by 2 in order to obtain the round-trip distance.

Instructional Emphases

For this objective students will need to determine which operations are necessary to solve a given problem. Instruction that focuses on how to translate words into the correct operations will be very helpful to students. You may want to review a step-by-step procedure such as the one outlined below.

1. Read the problem.

   Read the problem carefully to learn what is involved. Pay particular attention to the question being asked.

2. Determine the computations to be performed and their order.

   Decide exactly what computations are necessary to solve the problem. Review the test item to be certain that the operations are carried out in the correct order.

3. Perform the necessary computation(s).

   Perform the computations, making certain that the correct numbers are used. Double-check the computations to make sure they are accurate.

4. Is the answer reasonable?

   Look over the problem and decide whether your answer is sensible, given the situation presented in the problem. If your answer seems unreasonably large or small, reread the problem and start again.

Students should know that many multiple operations problems can be solved by more than one approach. You may want to demonstrate this fact to students using an example such as that presented below. Emphasize to students that they should use the solution strategies that make the most sense to them.

> Alicia and Ron got a part-time job typing a book. They each were paid $2.00 per page. One evening Alicia typed 12 pages and Ron typed 9 pages. How much more than Ron did Alicia earn that evening? (answer $6.00)

Path 1: Step 1:

$$\begin{array}{r} 12 \\ \times\ 2 \\ \hline 24 \end{array}$$

Alicia's earnings

Step 2:
9
x2
18 Ron's earnings

Step 3:
24
-18
6 dollars

Path 2: Step 1:
12
- 9
3 difference between the number of pages Alicia typed and the number that Ron typed

Step 2:
3
x2 earnings per page
6 dollars

Possible Instructional Activities

Creating Problems

Divide the class into pairs of students. Give each pair of students a different sheet of directions that specifies (1) a topic for a word problem (for example, football scores, a school play, a vacation) and (2) two of the four basic operations (addition, subtraction, multiplication, and division). Have each pair create a two- or three-step word problem using the particular set of rules given to them. Direct different pairs to present their problem to the class. The class should first evaluate whether or not a given problem fits the rules and then solve the problem.

Many Outcomes

Create simple word problems that are accompanied by questions for students to answer. Try to develop the situation so that a variety of operations can result from each problem. The following is an example.

Angelo caught 26 fish, Karen caught 9 fish, and Roger caught 4 fish.

1. How many fish did the three people catch in total? (addition)

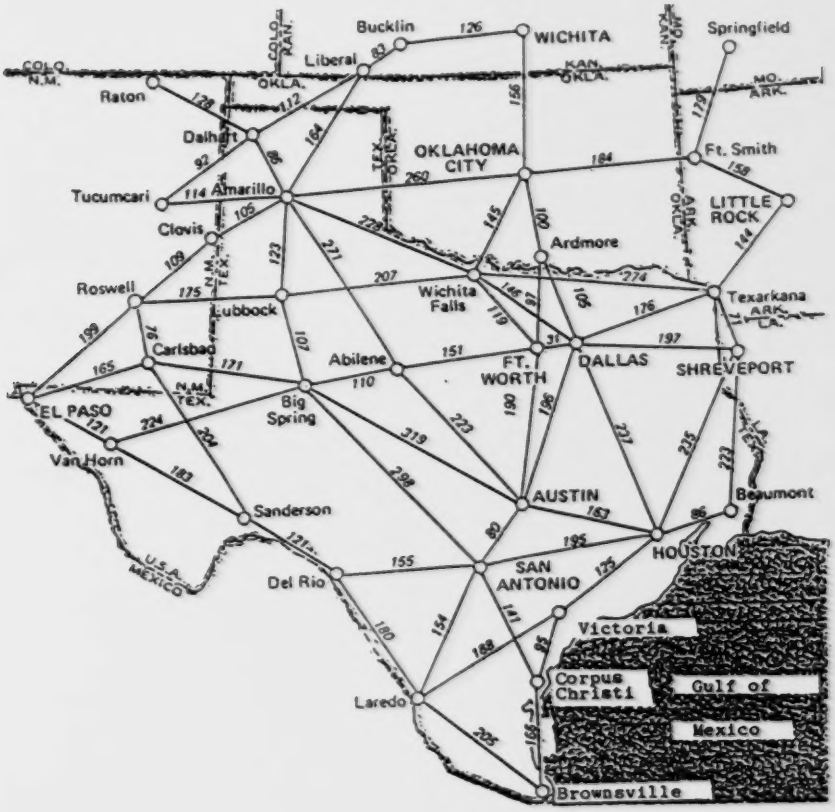
2. How many more fish did Angelo catch than Roger? (subtraction)

3. If everyone sold their fish for $1.00 each and split the money evenly, how much would each person earn? (multiplication, addition, division)

4. If Angelo lost 4 fish and then gave the rest to Roger, how many fish would Roger have? (subtraction, addition)

Driving Calculations

Distribute a map like the one below to students. Divide the class into groups of two or three students. Tell the groups to solve the problems posed by the trips described below. Alternatively, have students invent trips and perform the word problems that their adventures create.



1. How much farther will Steven drive if he goes from Oklahoma City to Fort Worth via Wichita Falls instead of via Ardmore?

2. Kate and Teresa decide to go from Amarillo to San Antonio for their vacation. They average 44 m.p.h. and split the driving equally. By the time they reach San Antonio, how many hours will each one have driven?

3. A salesman is paid $1.00 for every five miles he drives. On Thursday he drove from Carlsbad, past Sanderson, to Del Rio. How much was he paid for mileage that day?

4. Rose Marie lives in Dallas and must decide whether to take a trip to Houston or Wichita Falls. How many more miles will she drive if she makes a round-trip from Dallas to Houston than if she makes a round-trip from Dallas to Wichita Falls?

Objective 5: Solve word problems using ratios, proportions and percents.

This objective requires students to solve word problems using ratios, proportions, and percents. Only one of these skills will be tested in any one item.

Sample Item

In the student council election, Marcy received 55% of the votes. If a total of 220 students voted, how many students voted for Marcy?

A. 121 students

B. 111 students

C. 165 students

D. 55 students

Test Question

1. In problems involving ratio, a test item will present a word problem containing two numbers and ask the student to express the numbers in a ratio. The ratios will be expressed as A:B, A to B or $\frac{A}{B}$. No number in the ratio will be larger than three digits.

2. In problems involving proportion, a test item will require the completion of a proportion. The student must apply a ratio to a quantity to determine the proportional quantity (that is, solve for $\square$ in $\frac{\square}{X} = \frac{Y}{Z}$). The ratio will be given in simplest terms and the quantity will be a number not larger than three digits.

3. In problems involving percent, an item will ask either: (1) what quantity of a number a given percent represents (30% of 120 = [quantity]), or (2) what percent a given number is of another number (6 out of 25 = [percent]). All percents will be whole numbers between 1 and 99.

Answer Choices

1. The correct answer will be the exact solution to the problem presented.

2. Incorrect answer choices are likely to result from one or more the following types of errors:

   a. Computation Error: An error in the addition, subtraction, multiplication, or division of two numbers.

   b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   c. Incorrect Simplification: Incorrectly simplifying a fraction.

   d. Missing Operation: Not operating on the data or omitting one of the required operations.

   e. Incorrect Operation: Performing an operation other than the required one.

   f. Incorrect Data Error: Performing a necessary operation on the wrong data.

Answer Analysis for the Sample Item

1. Answer choice A is the correct response, as illustrated below. The problem is set up correctly, and the computations are accurate.

```
   220
  x.55
  1100
 1100
121.00 students
```

2. Answer choice B is incorrect because of a regrouping error in the second partial product, as illustrated below:

```
   220
  x.55
  1100
 1000
111.00
```

3. Answer choice C is incorrect as the result of using an incorrect operation. This answer choice is obtained by subtracting 55% percent from 220, as shown:

```
  220
- 55
  165
```

4. Answer choice D is incorrect because of a missing operation. The percentage from the problem is selected as the answer without performing any calculation.

Instructional Emphases

Students will be required to solve three types of problems in this objective. Therefore, students should first determine what type of computation is appropriate. By reading the question carefully and studying each number in the item, students should be able to determine the appropriate operations. Presented below is a step-by-step outline for solving each type of problem. You may want to review these outlines with your students.

Solving Ratio Problems

1. Read the item carefully; the question will identify two quantities that are to be placed in a ratio (for example, the ratio of apples to oranges when there are 96 apples and 24 oranges).

2. Create the correct ratio by placing the numbers in the correct order, according to the question asked. Thus, the ratio of apples to oranges mentioned above must be 96:24, not 24:96.

3. Reduce the ratio to lowest terms by finding the lowest common denominator (LCD) for the numbers in the ratio. Divide each by the LCD.

$$\begin{array}{r} 4 \\ 24\overline{)96} \\ \underline{96} \\ 0 \end{array} \qquad\qquad \begin{array}{r} 1 \\ 24\overline{)24} \\ \underline{24} \\ 0 \end{array}$$

The ratio of apples to oranges is therefore 4 to 1.

Solving Proportion Problems

1. Identify the ratio specified in the problem. Key words that may be used to describe a ratio are "out of" (4 out of 8 attempts), "on" (50 miles on 2 gallons of gas), "to" (wins to losses), and "for" (3 computers for every 10 students).

Consider the following problem.

> Gregory is planning a big party. He estimates that he will need 2 cakes for every 16 guests. How many cakes will he need to feed 80 guests?

The ratio specified in the problem is "2 cakes for every 16 people."

2. Express the ratio in fraction form and label the units. For example:

$$\frac{2 \text{ cakes}}{16 \text{ guests}}$$

3. Form a ratio between the additional value presented in the problem and the missing value. In the example above, the additional value is 80 guests, and the missing value is the number of cakes. The values in the new ratio must correspond to the placement of similarly labeled values in the first ratio. Thus, in the example, the second ratio should take the form $\frac{x \text{ cakes}}{80 \text{ guests}}$ rather than $\frac{80 \text{ guests}}{x \text{ cakes}}$ because the first fraction is expressed as $\frac{2 \text{ cakes}}{16 \text{ guests}}$.

4. Form an equality between the two ratios. Cross-multiply and divide to solve for the missing value:

$$\frac{2 \text{ cakes}}{16 \text{ guests}} = \frac{x \text{ cakes}}{80 \text{ guests}}$$

$$16\,(x) = 2(80)$$
$$16x = 160$$
$$x = \frac{160}{16}$$
$$x = 10$$
$$\text{Answer} = 10 \text{ cakes}$$

Solving Percent Problems

Determining the quantity that a specified percent represents (for example, 20% of 140 = [quantity])

1. Translate the percent into a decimal by dividing by 100; in effect, move the decimal 2 places to the left:

$$20. \rightarrow .20. = .20$$

2. Multiply the decimal by the total quantity:

$$\begin{array}{r} 140 \\ \times .20 \\ \hline 000 \\ 280 \\ \hline 28.00 \end{array}$$

Possible Instructional Activities

Almanac Activities

Use the almanac to develop statistics sheets about various places or make up statistics about hypothetical places. Give the information to students along with a list of percents and ratios that they can complete. For example:

Fountain Hill

population: 780
televisions in use: 160
radios in use: 220
telephones in use: 300

-- What is the ratio of televisions to radios in Fountain Hill?

-- What is the ratio of telephones to people in Fountain Hill?

Greenville

working population: 900
percent of working population
by type of occupation:

Professional	55%
Farming	20%
Other	30%

-- How many people in Greenville are employed as professionals?
-- How many people in Greenville work in farming?
-- What is the ratio of professional people to farmers?

Keeping a Sense of Proportion

Have the class think up possible topics for ratios from their own experiences, and write the topics on the chalkboard. Give them some examples such as the following:

-- miles driven to miles walked last week

-- games won (for example, chess, baseball or football) to games played last month

-- hours spent watching television to hours spent doing homework last night

-- male friends to female friends

Ask students to determine personal ratios for the topics listed on the chalkboard. Then designate quantities that relate to particular ratios, and have students determine the appropriate proportion. For example:

Step 1: Have students determine their personal ratio of miles walked to miles driven in one month. Thus, a student who estimated 16 miles walked to 560 miles driven would have a ratio of $\frac{16}{580}$.

Step 2: Now, provide students with a new quantity for the number of miles driven. Ask them to imagine that they rode 650 miles in one month. Then ask them to compute the number of miles they would have walked in that month, based on the ratio computed earlier.

$$\frac{16}{580} = \frac{x}{650}$$

Give students new quantities for each personal ratio developed. After the class has completed one or two proportions, ask some students to demonstrate their calculations on the board.

Budget Busting

Have students develop a budget for a class or school project. Let them propose the budget items in percentages of the total budget. Then, designate a dollar size for the total budget, and have students calculate how many dollars each area of the budget will receive. You may also wish to have students compute ratios between the expenditures for various portions of the budget.

BBQ

Tell students to imagine that they are planning a barbeque and must determine how much food and drink to buy. Have students use the estimates presented below to determine how much of each food item to buy in order to feed 60 guests.

Ribs:	7 pounds for 6 people
Hot dogs:	8 hot dogs for 5 people
Corn on the cob:	5 ears for 4 people
Soft drinks:	25 cans for 10 people
Cakes:	1 cake for 12 people

Objective 6: Solve personal finance problems.

This objective requires students to solve personal finance problems.

Sample Item

Jessie ordered a sandwich for $3.35 and a glass of milk for $.65. Sales tax was 4%. What was her total bill?

A. $4.16

B. $4.00

C. $4.04

D. $3.84

Test Questions

1. Test items will relate to banking, personal records, cost comparisons, and taxes.

2. Numbers in banking and personal records will be limited to $1000.00 or less.

3. Cost comparisons will involve determining the best buy when the costs of three or four similar objects measured in the same units are compared.

4. Taxation problems will be limited to amounts of $5000.00 or less and will involve computation of sales tax, total cost including tax, or income tax.

5. Percents will be whole numbers.

Answer Choices

1. The correct answer choice will be the exact solution to the problem presented.

2. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the addition, subtraction, multiplication, or division of two numbers.

   b. Incorrect Operation Error: Performing an operation other than the one required.

   c. Incorrect Data Error: Performing a necessary operation on the wrong data.

d. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

e. Missing Operation: Not operating on the data or omitting one of the required operations.

Answer Analysis for Sample Item

1. Answer choice A is the correct response, as illustrated below. The problem is set up correctly, and all computations are performed accurately and in the correct order.

Step 1:	(add)	\$3.35 + .65 \$4.00
Step 2:	(multiply)	\$4.00 x .04 \$ .16
Step 3:	(add)	\$4.00 + .16 \$4.16

2. Answer choice B is incorrect because two required operations were omitted. (See steps 2 and 3 above.) Specifically, the tax was not computed; therefore, it was not added to the total cost of the meal.

3. Answer choice C is incorrect because a wrong operation was used. The 4% tax was computed by changing the percent to a decimal (.04) and then adding this value to the total cost of the meal (\$4.00).

4. Answer choice D is also incorrect because a wrong operation was used. The 4% tax was computed correctly (\$.16) but was subtracted rather than added to the total cost of the meal (\$4.00).

Instructional Emphases

This objective requires students to apply their problem-solving skills to the area of personal finance. These problems involve the use of basic operations (addition, subtraction, multiplication, and division) and percents. It is essential that students are familiar with the basic aspects of banking (interest, checks, accounts, and balance) and taxes (income and sales). Students may benefit from going over samples of sales receipts, tax forms, and banking forms.

Students should know which operations are associated with different types of problems. Banking problems typically require the use of addition and subtraction to balance accounts. Withdrawals involve subtraction, whereas deposits require addition.

Comparison-shopping problems typically require the use of division to determine the price per unit. For example, to determine whether a five-pound bag of rice that costs $2.50 is a better buy than a two-pound bag of rice that costs $1.50, the student must calculate the price per pound for each product and see which is less expensive. The price per pound for the five-pound bag of rice is $2.50 divided by 5, or $0.50. The price per pound for the two-pound bag of rice is $1.50 divided by 2, or $0.75. Therefore, the five-pound bag of rice is the better buy.

Tax problems usually require calculations that involve a percentage. It may be helpful to review the steps for solving word problems involving percentages (as explained in the "Instructional Emphases" of Objective 5).

Because this objective includes problems that often require multiple operations, students will benefit from practice in translating word problems into mathematical operations. You may want to review with students the step-by-step procedures for solving multiple-operation problems presented in the previous section.

Possible Instructional Activities

Bank It

Present banking situations to students to provide practice at calculating bank account balances. If possible, ask a local bank for sample deposit and withdrawal slips to use as part of your instructional activities. Present banking problems aloud, and have students calculate the balance of an imaginary bank account as you describe several recent transactions. For example:

> Robin has $280.50 in her checking account. She deposited $49.75 that she earned by babysitting. Then, over the next 3 weeks, Robin deposited $10.00 each week that she earned from running errands. Finally, she wrote a check for $98.03 to buy a coat. What is Robin's new checking account balance (assuming that no interest has been earned and no banking fees had to be paid during this period)?

When students have completed all the calculations, ask volunteers for their answers. Ask these students to demonstrate the solution to each step of the problem.

Traveling Taxes

Provide students with a list of expenses incurred during a trip to various cities in different states:

Location	Item	Price	Tax Rate	Tax Amount	Total Cost
Bellsville	dinner	$9.60	5%	_____	$10.08
Merit City	sandals	_____	5%	$0.40	_____
Goldtown	sunglasses	_____	8%	$1.28	_____
Weston	camera film	$7.50	6%	_____	_____
Northgate	lunch	$3.50	4%	_____	_____

For each line, one or two pieces of information are missing. Ask students to complete each line by using the information presented to solve for the missing information. Encourage students to set up the appropriate mathematical equations when performing this exercise.

To Buy or Not to Buy?

Tell students to imagine that they need the following items, which can be purchased at any of three stores. For each item, have students determine which store has the lowest price per unit of measure (for example, ounce, pound, object).

	STORE A		STORE B		STORE C	
	Price	Weight/ Quantity	Price	Weight/ Quantity	Price	Weight/ Quantity
Whitesmile toothpaste	$2.70	9 oz	$1.47	7 oz	$1.75	5 oz
Russet potatoes	$0.29	1 lb	$1.00	5 lbs	$1.70	10 lbs
Oatbran cereal	$2.72	17 oz	$2.40	16 oz	$1.80	15 oz
Magic erasers	$0.60	3	$1.10	5	$0.50	2
Foamy root beer	$0.55	1 can	$1.80	6 cans	$4.20	12 cans

SKILL AREA: MEASUREMENT

The skill area of measurement covers one objective, namely, solving word problems involving measurement.

Objective 7: Solve word problems involving metric/customary measurements using the basic operations.

This objective requires students to solve word problems involving measurement.

Sample Item

Bill is planning a party. He wants to make enough punch to fill 40 glasses. Each glass holds 150 milliliters. How many liters of punch should he make?
(1 liter = 1000 milliliters)

A. 110 liters

B. 4 liters

C. 6 liters

D. 60 liters

Test Questions

1. A test question will present a word problem whose solution may require two or three operations (addition, subtraction, multiplication, or division).

2. Eligible units of measure will be:

METRIC	CUSTOMARY
Length	
kilometer	mile
meter	yard
centimeter	foot
miilimeter	inch
Volume and Capacity	
liter	gallon
milliliter	quart
	pint
	cup
	ounce

Weight and Mass

kilogram	ton
gram	pound
milligram	ounce

Time

year
month
week
day
hour
minute
second

Temperature

Celsius Fahrenheit

3. A test item will provide a statement of equivalence between two units of measure if a conversion is required (for example, 1000 milliliters = 1 liter).

4. No test item will require conversion between metric and customary units.

Description of Answer Choices

1. All answer choices will be labeled with appropriate units.

2. The correct answer will be an exact solution to the problem presented.

3. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in addition, subtraction, multiplication, or division of two numbers.

   b. Decimal Error: Placing the decimal point in an incorrect position on either a correct or incorrect solution.

   c. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   d. Missing Operation: Not operating on the data or omitting one of the required operations.

e. Incorrect Data Error: Performing a necessary operation on the wrong data.

f. Incorrect Operation: Performing an operation other than the required one.

g. Misaligned Digit: Either (1) adding or subtracting a digit in one place to or from a digit in an adjacent place, or (2) misaligning partial products.

h. Measurement Conversion Error: Using an incorrect conversion constant.

i. Conversion Regrouping Error: Using a correct conversion constant but regrouping between units incorrectly.

Answer Analysis for Sample Item

1. Answer choice A is incorrect because of an incorrect operation. To obtain this result, 40 (glasses) was subtracted from 150 (milliliters) yielding 110.

2. Answer choice B is incorrect because there is a regrouping error. A failure to regroup in the first steps of the problem results in this answer as illustrated below:

Step 1: (total number of milliliters; regrouping error)

```
 150
x 40
 000
4000
4000 milliliters total
```

Step 2: (Conversion to liters; error from step one)

```
      4 liters
1000)4000
     4000
        0
```

3. Answer choice C is the correct answer. The total number of milliliters is determined in Step 1, then converted to liters in Step 2, as illustrated below:

Step 1: (total number of milliliters)

```
 150
x 40
 000
600
6000 milliliters total
```

Step 2: (conversion to liters)

```
      6 liters
1000)6000
     6000
        0
```

4. Answer choice D is incorrect because of the misplacement of

the decimal point. The correct conversion constant is used, but an error in decimal placement in the division results in an answer expressed in tens instead of ones.

Instructional Emphases

Measurement problems found in this skill area emphasize two skills: (1) problem solving using basic operations, and (2) conversion from one unit of measure to another. In assisting students with these problems, you may find it useful to focus instruction separately on the individual skills. Once students are proficient with the skills individually, the skills can be combined into a single problem.

An approach to solving word problems has been discussed at length under Objective 4 of this guide. You may wish to refer to that section. Briefly, students should read the problem carefully and make note of what the question asks. Then they must translate the word problem into one or more computations that reflect the activities in the word problem. Finally, the student needs to compute the answer and check to see that the number arrived at is a reasonable solution to the problem.

Measurement problems may require that the student decide how to convert from one unit of measure to another. When converting from large units (for example, meters) to smaller units (for example, centimeters) division is necessary. When converting from small units to larger units, multiplication is required. To know what the relation is between two units of measure, students should refer to the equivalence statement (for example, 100 centimeters = 1 meter) provided with each item. Solving word problems involving measurement requires that students pay close attention to the measurement units specified in the problems. Students should also check what units of measure the answer calls for and then solve the problem by converting all values to that unit.

The instructional activities presented below are designed to provide students with practice in measurement conversion. Activities to reinforce word problem skills are provided under Objectives 5, 6, and 7. Many of the activities found in those objectives can be modified for use with this objective.

Possible Instructional Activities

Complete the Conversion

Give students the following measurement equations to complete. Provide a conversion chart for students to use in solving these equations.

40 millimeters	=	____ centimeters
96 minutes	=	____ hours ___ minutes
65 ounces	=	____ pounds ___ounces
11 gallons	=	____ quarts
216 centimeters	=	____ meters
5 kilograms	=	____ grams
39 months	=	____ years ___months
47 feet	=	____ inches
11 pints	=	____ quarts ___pints
3,650 meters	=	____ kilometers

Create other conversions for additional practice.

Geographic Conversion

These problems require students to convert geographic measurements to other units as specified.

		Measurement in Specified Unit
-- Volcanoes		
Mauna Loa, Hawaii	Height: 2.59 miles	_____ feet
Chimborago, Equador	Height: 3.894 miles	_____ feet
-- Lakes		
Great Bear Lake, Canada	Depth: 44600 centimeters	_____ meters
Lake Baykal, U.S.S.R.	Depth: 1.62 kilometers	_____ meters
Lake Huron, U.S.-Canada	Depth: 9000 inches	_____ feet
-- Rivers		
Brazos, Texas	Length: 2,129,600 yards	_____ miles
Loire, France	Length: 1,020,324 meters	_____ kilometers
Rio Theodore Roosevelt, Brazil	Length: 2,112,000 feet	_____ miles
-- Mountains		
Uncompahgre Peak, Colorado	Height: 2.71 miles	_____ feet
Tyree, Anarctica	Height: 3.085 miles	_____ feet
McKinley, Alaska	Height: 6.193 kilometers	_____ meters
-- Rainfall		
Reykjavik, Iceland	Annual Average: 2.82 feet	_____ inches
Washington, D.C.	Annual Average: 3.24 feet	_____ inches
Pago Pago, Samoa	Annual Average: 16.13 feet	_____ inches
Riyadh, Saudi Arabia	Annual Average: 81.28 millimeters	_____ centimeters
Mount Waialeak, Hawaii	Annual Average: .01168 kilometers	_____ centimeters

Measure Happy

Have students measure (or estimate the dimensions of) objects around the classroom (for example, a student's height, the weight of a book). List these things and their measurements in metric or customary units on the board. After about 10 objects have been listed, tell students to convert the measurements into different specified units of measure within the customary or metric system.

SKILL AREA: GEOMETRY

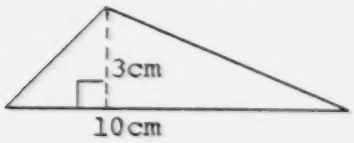
The skill area of geometry covers one objective that involves solving for the area of rectangles and triangles.

Objective 8: Find the areas of rectangles and triangles.

This objective requires students to compute the area of certain geometric figures. Formulas will not be provided.

Sample Item

What is the area of the triangle below?



A. 39 cm^2

B. 15 cm^2

C. 169 cm^2

D. 30 cm^2

Test Questions

1. A test question will require students to determine the area of the figure presented. Eligible figures will include rectangles (including squares) and triangles (all types).

2. Each figure will be labeled with the minimum number of dimensions necessary to determine its area. The dimensions of figures will be in whole numbers.

3. Formulas will not be presented.

Answer Choices

1. Answer choices will be labeled in square units. Square unit labels will be abbreviated as follows:

metric	customary
cm^2	$in.^2$ or sq in.
m^2	ft^2 or sq ft
	yd^2 or sq yd

2. The correct response will be the exact solution to the problem presented.

3. Incorrect responses are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the addition, subtraction, multiplication, or division of two numbers.

   b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   c. Missing Operation: Not operating on the data or omitting one of the required operations.

   d. Incorrect Data Error: Performing a necessary operation on the wrong data.

   e. Incorrect Operation: Performing an operation other than a required one.

Answer Analysis for Sample Item

1. Answer choice A is incorrect because of the use of incorrect operations. This answer choice is obtained by multiplying the base by 3 and the height by 3 (for the three sides of the figure) and then adding those 2 products together. This is inconsistent with the formula for the area of a triangle.

2. Answer choice B is the correct response. The formula for the area of a triangle is A = 1/2 bh. When the formula is applied correctly and the computations are accurate, this answer choice is obtained.

Step 1:	(substitute values into formula)	A = (10 x 3)
Step 2:	(perform operation in parentheses)	10 base x 3 height 30

Step 3: (perform operation outside parentheses)

$\frac{1}{2}(30) = 2\overline{)30}$ $\begin{array}{r} 15 \\ \\ 2 \\ \hline 10 \\ 10 \\ \hline 00 \end{array}$ cm

3. Answer choice C is incorrect because of the use of incorrect operations. The formula for the area of a triangle is not employed. This answer choice results from adding the base to the height, then squaring the sum.

4. Answer choice D is incorrect because a necessary operation is missing. Multiplying the base times the height (10x3=30) is a correct step, but that product must be multiplied by $\frac{1}{2}$ (or divided by 2) to arrive at the correct answer.

Instructional Emphases

This objective requires that students understand the concept of area, know the appropriate formulas, and use these formulas correctly to compute the area of various geometric figures. Below is a general step-by-step procedure that you may wish to review with your students. These steps are applicable in determining the area of any geometric figure.

1. Determine which type of figure is pictured.
2. Decide which formula is appropriate.
3. Locate the dimensions called for in the formula.
4. Fill in the formula and calculate the answer.
5. Double-check the calculations to make sure they are correct.

In introducing the formulas for area, point out what distinguishes a given shape and its formula from other ones. A brief discussion of each shape and formula is presented below.

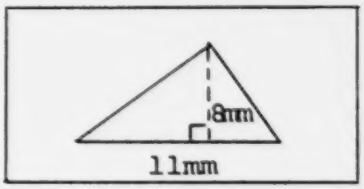
Rectangles: Area = length x width (A=lw). Because parallel segments of a rectangle are equal, only two dimensions are necessary to compute the area of a rectangle: length and width. Students must remember that these two dimensions are multiplied, rather than added (as in perimeter), to obtain the area. You may want to explain to students that a square is a special type of rectangle in which the length and width are identical. Therefore, the formula for the area of a rectangle applies to a square as well. For a square, length times width is equal to $side^2$. Thus, the formula for area of a square is Area = $side^2$ ($A=S^2$).

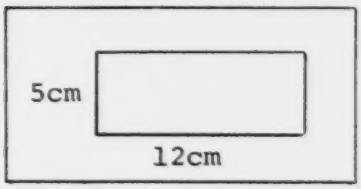
Triangles: Area = $\frac{1}{2}$ base x height (A= $\frac{1}{2}$bh). A triangle can be thought of as half a square or rectangle, hence the formula. Students frequently have difficulty determining the area of triangles. This may be because students either do not remember the formula or use the formula incorrectly. The easiest way to use the formula is to multiply the base times the height, then divide the resulting product by 2. Remind students which dimensions are the base and the height. Ample opportunity for practice with triangles should enhance students' performance in this area.

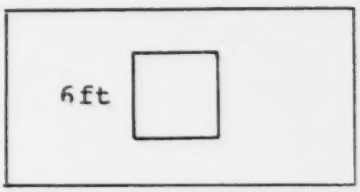
Possible Instructional Activities

Area Study

Draw different sizes of rectangles, triangles, and squares on index cards. Provide dimensions (metric and customary) for each figure. For example:







Write the area of the figure on the back of each card. These cards can be used for self-study or in groups. Students can check their answers by comparing them with those written on the backs of the cards.

Cut and Measure

Distribute construction paper and scissors to students. Have each student cut out an equilateral, scalene, or isosceles triangle of any size. Tell students to determine the area of their triangle. Students should write their initials on their triangle and record the area on a separate piece of paper.

Collect the triangles and redistribute them so that each student has a new triangle. Have the students measure and compute the area of their new triangle and record their answer. Then, allow students to find the creator of the triangle they possess. The two students compare their computations and determine the correct area of the triangle. Let students continue working among themselves until all the triangles have been checked.

On Your Behalf

As indicated in the Instructional Emphases section, students frequently need help in remembering how to compute the area of triangles.

Some students may find it useful to rely on a "word device" to remember the formula for the area of a triangle. The word behalf can serve as such a device because it contains all the elements of the formula:

beHALF $\frac{1}{2}$

Behalf base

beHalf height

BeHalf $= \frac{1}{2}$ base x height

"Remember behalf, or you'll end up behind."

Encourage students to remember the word and to use its clues to recall the formula they need.

SKILL AREA: PROBABILITY, STATISTICS, AND GRAPHING

The skill area of probability, statistics, and graphing covers two objectives: probability as well as charts and graphs.

Objective 9: Determine simple probabilities.

This objective requires students to solve word problems involving simple probabilities.

Sample Item

In a cupboard there are 7 cans of mushroom soup, 4 cans of tomato soup, and 6 cans of vegetable soup. If you choose a can without looking, what is the probability that it will be vegetable soup?

A. 6 out of 17

B. 6 out of 11

C. 1 out of 6

D. 1 out of 3

Test Questions

1. A test item will require the calculation of the probability of an independent event in a given situation.

2. The frequency of the event of interest and the frequency of other possible events will be presented in the item.

Answer Choices

1. Answer choices will be expressed in a fractional form or "out of" form.

2. The correct answer choice will be the probability of the event described in the problem and will not be simplified.

3. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Missing Operation: Not operating on the data or omitting one of the required operations.

   b. Incorrect Data Error: Performing a necessary operation on the wrong data.

c. Incomplete Operation: Failing to use all the data necessary to perform an operation.

Answer Analysis for Sample Item

1. Answer choice A is the correct response. The frequency associated with the specified event (number of cans of vegetable soup) is identified correctly, and the number of possible events is summed correctly to express the probability of 6 out of 17.

2. Answer choice B is incorrect because of failure to use all the necessary data in determining the total number of possible events. The value 11 is the sum of cans of mushroom and tomato soup and does not include the cans of vegetable soup.

3. Answer choice C is incorrect because the wrong data are used to obtain this result. This answer (1 out of 6) represents the probability of selecting a particular can of vegetable soup when the total number of possible events is six cans of vegetable soup.

4. Answer choice D is also incorrect because the wrong data are used to obtain this result. This answer (1 out of 3) represents the probability of selecting any one type of soup, if there were equal numbers of cans for each type of soup.

Instructional Emphases

Explain to students that simple probability allows us to determine how likely it is that a certain event or outcome will occur. Probability can be expressed by a fraction or ratio of the number of times a specified event occurs to the total number of possible events. Probability can also be expressed as the number of times a specified event occurs out of the total number of possible events.

Probability Statement:

(1) Probability of a particular event = $\frac{\text{number of times a specified event occurs } (x)}{\text{total number of possible events } (y)}$

(2) Probability of a particular event = x out of y

The probability of an event always takes on a value from 0 to 1. If an event has probability 0 ($\frac{0}{0}$, or 0 out of 1), that means it cannot possibly happen. If an event has probability 1 ($\frac{1}{1}$, or 1 out of 1), that means it must happen.

Students need to know how to extract the essential probability information from a word problem and how to place the numbers in a probability statement. Students should be able to do this once they understand how to interpret probability statements. The number of times the event of interest occurs will be the smaller number and is always on the top half of the probability ratio or the first number in an "out of" statement. The total number of events will be the larger number and is always on the bottom of the probability ratio or the second number in the "out of" statement.

You may want to emphasize to students that the total number of "possible events" refers to all possible events described in the question including the event of interest. Students should also be told that possible events can refer to a wide variety of things including objects, occurrences, people, animals, etc.

Possible Instructional Activities

Names in the Box

To familiarize students with the concept of probability, have each student write his or her full name on a piece of paper (all the pieces should be identical). Fold each piece in a similar manner, and place the slips in a box. Then, having informed students of the total number of slips of paper, ask them to determine the probability of an individual selecting his or her own name.

For a different task, have students count the number of males and females in the class to determine the probability of selecting a girl's or boy's name from the box. Ask one student to select 10 names from the box, one at a time, noting each time whether a male or female name was selected. Put the selected name back in the box each time to keep the probabilities constant. Determine whether the estimated probabilities for selecting male and female names (for example, 15 female names out of 30 names, or 5 out of 10) match the actual selections. Discuss the reasons that probability estimates sometimes fail to coincide with actual events.

Candy Count

Place known quantities of different colors of wrapped, hard candies in a bowl (for example, 10 greens, 5 reds, 15 yellows). Next, having told students the number of candies of each color in the jar, ask them to determine the probability of a blindfolded person selecting a:

a. green candy
b. red candy
c. yellow candy
d. candy that is not green
e. candy that is not red
f. candy that is not yellow

You may wish to illustrate the probabilities involved by having a blind-folded student select 30 candies, one at a time (replacing the selected candy in the jar each time to keep the probabilities constant), to see how well the estimated probabilities match the actual selections. Mix the bowl after each selected candy is put back.

Now remove all the green candies from the bowl. This will change the "total number of possible events" from 30 to 20. Ask students to determine the new probabilities associated with the questions presented above.

You may want to go one step further by removing all the yellow candy from the bowl in order to demonstrate that the probability of now selecting a red candy is $\frac{1}{1}$ or 1.

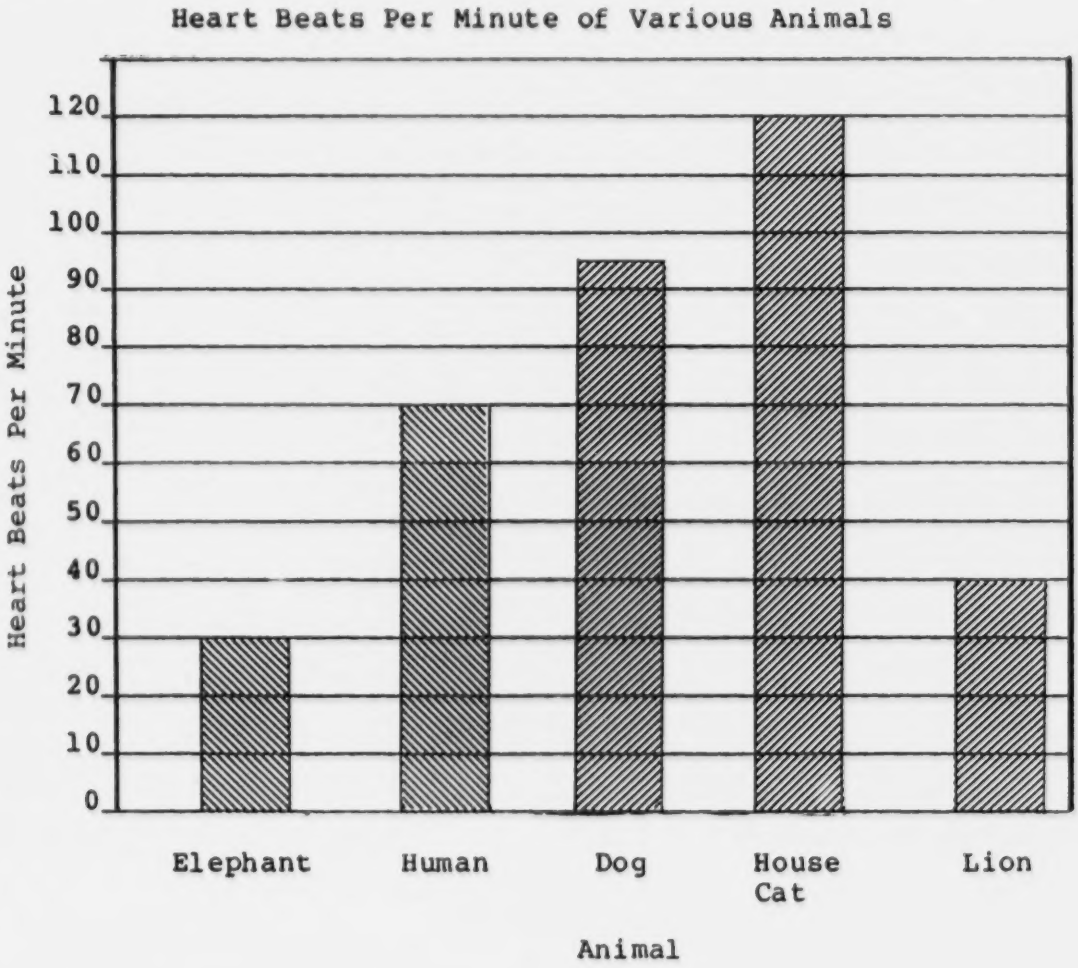
Win or Lose

On the board, write down the number of wins and losses of various sports teams (baseball, football, soccer, or basketball) reported in a recent city or school newspaper. For each of the teams, have students determine the probability of a win at the next game based on each team's previous record. Ask for volunteers to present their answers to the class.

Objective 10: Use information from charts or graphs to solve word problems.

This objective requires students to solve word problems using information from graphs and charts.

Sample Item



How many more times does a house cat's heart beat in one minute than a dog's heart?

A. 80 beats per minute

B. 30 beats per minute

C. 25 beats per minute

D. 120 beats per minute

Test Questions

1. A test item will present a graph or chart and will require the application of one or two operations on data from the display. The operations may include addition, subtraction, multiplication, or division.

2. Numbers from displays will be whole numbers no larger than three digits.

3. Types of graphs that will be used are bar, line, circle, or picture graphs.

4. Interpolation between units on a graph will be limited to half units.

Answer Choices

1. The correct answer choice will be the solution to the word problem based on information obtained from the presented graph or chart.

2. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Incorrect Operation: Performing an operation other than the required one.

   b. Missing Operation: Not operating on the data or omitting one of the required operations.

   c. Incorrect Order: Performing the required operations in the wrong order.

   d. Incorrect Selection of Information: Selecting the wrong information from a graph or chart.

   e. Scaling Error: Using a scale other than the one presented.

   f. Inaccurate Interpolation: Failing to interpolate between two marked units or interpolating incorrectly.

Answer Analysis for Sample Item

1. Answer choice A is incorrect as a result of selecting inaccurate information. This answer is the difference between the heart beats per minute of a house cat and a lion (120-40=80), not between a house cat and a dog.

2. Answer choice B results from inaccurate interpolation. The bar for dogs is read as 90 rather than 95 beats per minute. This error is then incorporated in the subtraction operation (120-90=30).

3. Answer choice C is the correct response. The average heart beats per minute for dogs is accurately subtracted from the average heart beats per minute for house cats (120-95=25).

4. Answer choice D is the result of a missing operation. The heart beats per minute for house cats (120) is read from the graph, and no operations are performed.

Instructional Emphases

This objective requires students to obtain information from a graph or table and to answer a question related to that information by performing computations. It may be a good idea to focus your instruction on how to read information from graphs and charts as computation skills will be covered in a variety of other objectives.

To help students learn how to interpret a display you may want to discuss examples of various types of graphs and charts including the primary purpose of each type of display:

1. Bar Graphs

   A bar graph typically shows the relative status of data, such as the number of calories in different flavors of ice cream or the gas mileage obtained by various cars. The bars can be compared with each other according to their relative length. Bars can be displayed either vertically or horizontally.

2. Line Graphs

   A line graph typically shows the change in data, such as variations in rainfall across years or changes in the number of student absences for various months.

3. Circle Graphs

   A circle graph typically shows data as percents, such as the percent of time spent studying by subject area or the percent of weekly allowance spent on various items. It is important for students to realize that the segments of a circle graph add up to 100 percent.

4. Picture Graphs

Picture graphs, like bar graphs, show the relative status of data, such as the number of students in various schools. A symbol is used to represent a specified number of items. For example the symbol could be used to represent 50 students. The number of students per school could then be represented by the number of symbols displayed.

5. Charts

Charts are used to organize and display (in rows and columns) a large amount of numeric information.

An important factor to consider when solving word problems for this objective is that graphs and charts contain both essential and non-essential information. Therefore, it is important for students to pinpoint the information that is required to answer a particular question.

Possible Instructional Activities

It's All in a Graph

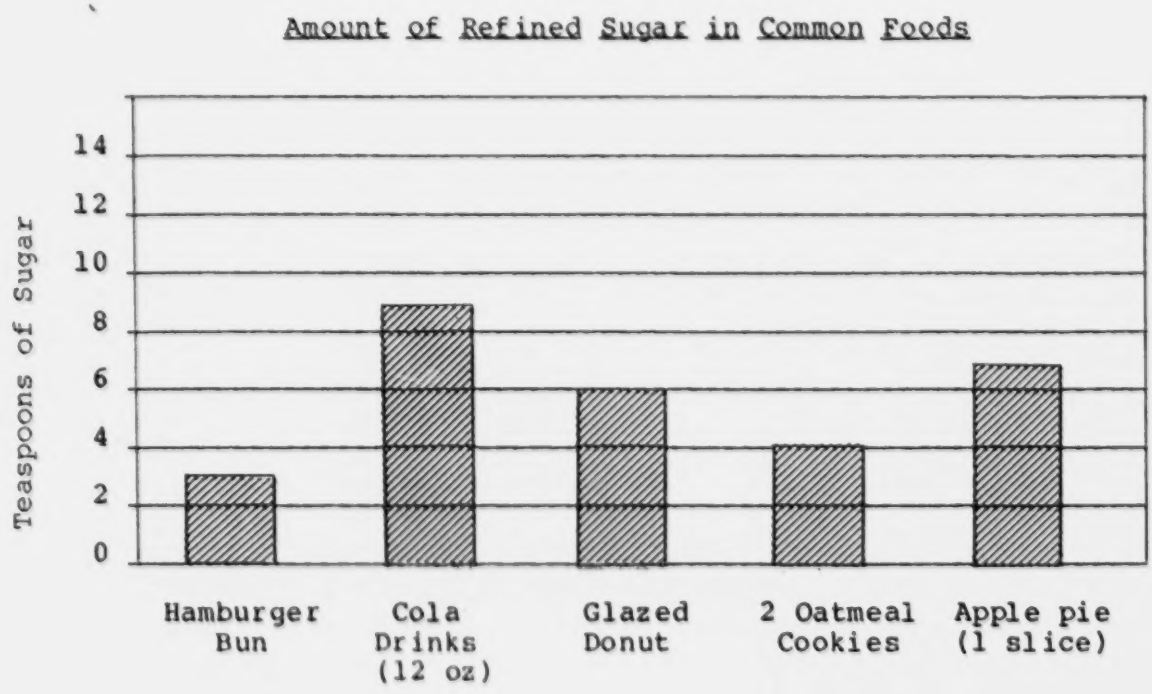
For homework, have students find two different types of graphs in newspapers or magazines. For each graph, have students identify the type of graph and briefly explain the topic of the graph.

Select several of the graphs to discuss in class. Draw the graphs on the board or make copies for students to share. Use the graphs to ask questions that require students to perform one or two computations.

Graph-O-Rama

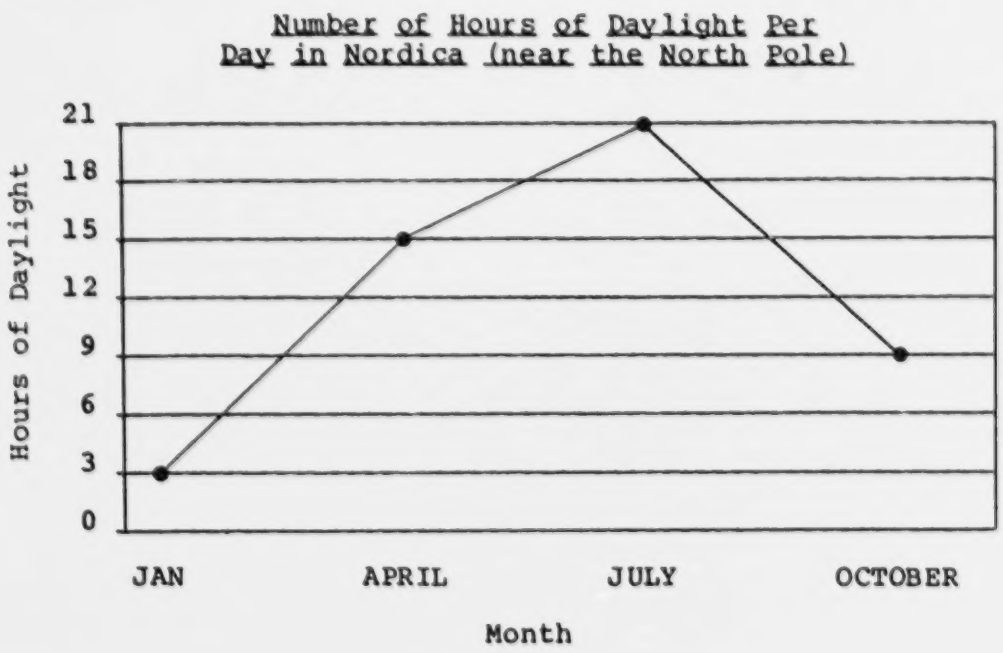
Give each student a copy of the graphs/chart on the following pages. There is one example for each type of display included on TEAMS (bar graph, line graph, circle graph, picture graph, chart). Have students solve the problem related to each display. Also, have students make up additional questions for the class to solve based on the graphs/chart.

Bar Graph:



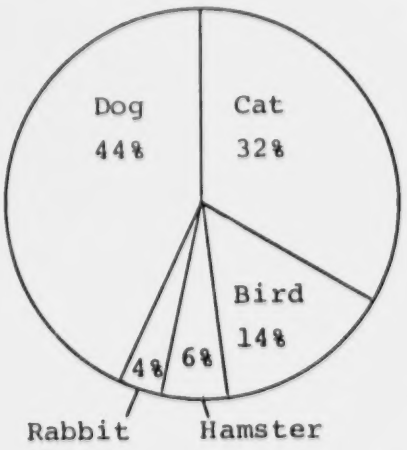
How much more sugar is in a glazed donut than in a hamburger bun? _____

Line Graph:



How many more hours of daylight are there per day during October than during January? _____

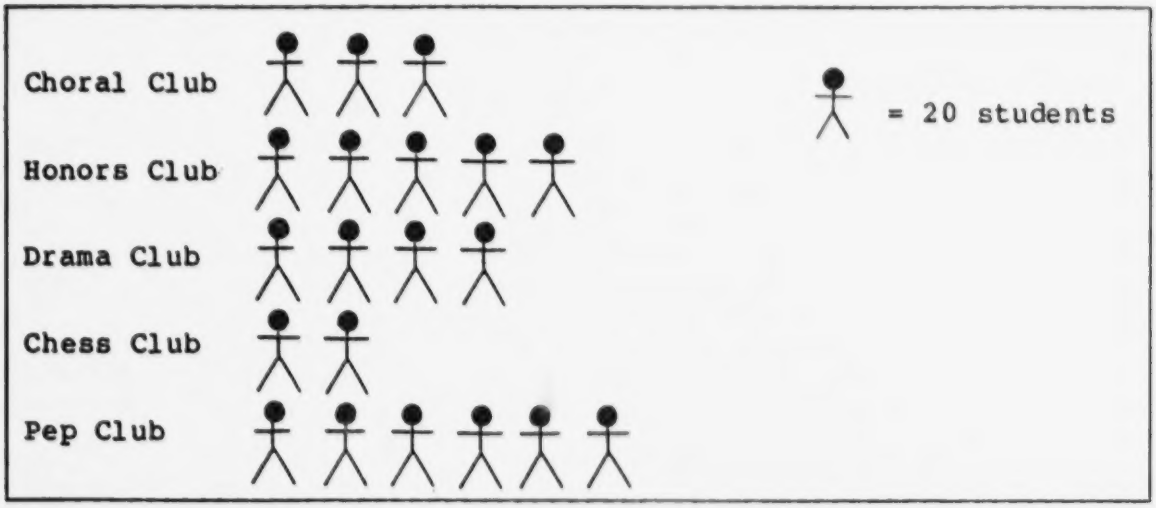
Circle Graph:



What percent of the students surveyed named a dog or a cat as their favorite pet? _____

Picture Graph:

Number of Students in Selected Clubs
at Northridge High School



How many more students are there in the Pep Club than in the Drama Club? _____

Table:

Summer Olympic Games Final Medal Standings: 1984

Nation	Gold	Silver	Bronze
United States	83	61	30
West Germany	17	19	23
China	15	8	9
Italy	14	6	12
Japan	10	8	14
South Korea	6	6	7

How many Gold and Silver medals did the United States win during the 1984 Summer Olympics? _____

Graph It with Bars

Have students construct a bar graph. For example:

a. Have students keep track of how many times (or minutes) they talk on the telephone each day for one school week (five days). Students should summarize the information and make a bar graph to display the summarized data. When constructing the graph, students should use one bar for each day. Be sure students label their graphs.

b. Have students conduct a mini-survey. Students could ask their friends about their favorite school subjects. Students' responses could be placed in the following categories: Mathematics, Art, History, English, P.E., Science. Students should show the results of the survey in a bar graph, using one bar to represent each category. Be sure students label their graphs carefully. This survey activity can be adapted to match the interests of your students.

Have students develop questions related to the information on the graphs. Each question should require one or two operations. Students can work in pairs and exchange graphs and problems. Or, select several volunteers to draw their graphs on the board and write their questions below the graph. Have the other students solve each problem.

SKILL AREA: ALGEBRAIC CONCEPTS

The skill area of algebraic concepts consists of one objective that involves using formulas to solve problems.

Objective 11: Use formulas to solve problems.

This objective requires students to solve problems using formulas. Formulas for calculating the following quantities are eligible for testing: the volume of a cube, the volume of a rectangular solid, the area of a circle, and simple interest. The formulas will be provided in the items.

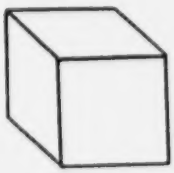
Sample Item

Select the appropriate formula and solve the problem:

$V = s^3$
$V = lwh$
$A = \pi r^2$ using 3.14 for π
$i = prt$

Find the volume of the cube shown below.

8.1 m



A. $65.61\ m^3$

B. $531.441\ m^3$

C. $206.154\ m^3$

D. $24.3\ m^3$

Test Questions

1. For items involving volume and area, students will be directed to find the volume or area of a given geometric shape. For items involving computation of interest, a word problem will be presented.

2. Test questions will present the following formulas together, as a group:

   Volume of a cube: $V = s^3$
   Volume of a rectangular solid: $V = lwh$

   Area of a circle: $A = \pi r^2$, where $\pi = 3.14$
   Interest: $i = prt$

3. A minimum number of dimensions necessary for solving the problem will be labeled.

4. Test items may involve decimals but not fractions.

Answer Choices

1. The correct answer will be the exact solution to the problem presented.

2. Answer choices will be labeled with abbreviations for appropriate units (for example, sq ft or ft^2, cu in. or $in.^3$, cm^2, m^3)

3. Answer choices may contain decimal numbers but not fractions.

4. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the addition, subtraction, multiplication, or division of two numbers.

   b. Incorrect Operation: Performing an operation other than the required one.

   c. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   d. Missing Operation: Not operating on the data or omitting one of the required operations.

   e. Incorrect Formula: Not using the correct formula to solve the problem.

Answer Choice Analysis for Sample Item

1. Answer choice A is incorrect because of a missing operation. The appropriate dimension (8.1) is squared to obtain 65.61 rather than cubed.

2. Answer choice B is the correct response. The formula for the volume of a cube ($V = s^3$) is correctly applied to the dimensions of the figure, and the calculations are correct as shown below:

   Step 1: $V = 8.1^3$

   Step 2:
   $$\begin{array}{r} 8.1 \\ \times 8.1 \\ \hline 81 \\ 648 \\ \hline 65.61 \end{array}$$

   Step 3:
   $$\begin{array}{r} 6561 \\ \times\ 8.1 \\ \hline 6561 \\ 52488 \\ \hline 531.441\ m^3 \end{array}$$

3. Answer choice C is incorrect because of the use of an incorrect formula. This answer choice is obtained by applying the formula for the area of a circle ($A = \pi r^2$) to the cube pictured in the problem ($A = 3.14 \times 8.1^2 = 206.054\ m^3$)

4. Answer choice D is incorrect due to the use of an incorrect operation. The correct dimension, 8.1 m, is multiplied by 3 rather than cubed, as shown.

   $$\begin{array}{r} 8.1 \\ \times\ 3 \\ \hline 24.3 \end{array}$$

Instructional Emphases

Proficiency at this skill requires that students recognize particular geometric figures (cube, rectangular solid, circle) and link these figures to their respective formulas for area or volume. In addition to geometric formulas, this objective covers calculation of interest. Regardless of the type of formula involved, students must know how to substitute values into the formula. This requires that they know what each of the variables in the formulas represents. Below are some brief suggestions regarding the presentation of each of the specific problem types presented under this skill.

Cubes: (volume = s^3) Students should be able to distinguish a cube from a rectangular solid by its shape. A cube is a special kind of rectangular solid in which the three dimensions are equivalent in length. Students must also know the procedure for cubing a number.

Rectangular Solids: (volume = lwh) Rectangular solids can be distinguished by their general shape and by the three dimensions provided on the figure. Be certain that students know to multiply, not add, the three dimensions.

Circles: (Area = πr^2) Students must be able to identify the elements of a circle and, in particular, distinguish the radius from the diameter. Also, they must be able to apply the value of π (3.14) in their computations.

Interest Rates: ($i = prt$) This formula requires students to locate at least three pieces of information in the problem: (1) amount of principal, (2) interest rate, and (3) period of time for which the interest is being calculated. Many interest rate problems ask how much money will be in an account after a specified period. Solving such problems requires that students add the total interest computed to the principal stated in the problem. Other problems ask for the total amount of interest earned over a specified period. Thus, students must read each interest rate problem carefully to determine what solution is required. Interest rate problems will not involve compound interest.

Possible Instructional Activities

Solid Practice

Have students locate several rectangular solids in their classroom, school, or home. Such objects can include books or boxes. Give students rulers (ideally both customary and metric) and have them measure an object to the nearest appropriate unit (for example, centimeter or inch) and then compute the object's volume using the formula V = lwh.

Formula for Success

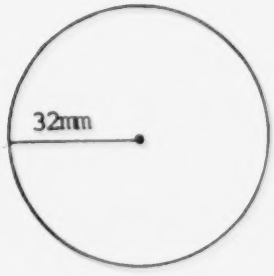
Money management magazines (or perhaps the business sections of major newspapers) contain charts of interest rates from various savings institutions and money market accounts. Distribute such a chart to students. Develop problems by specifying different amounts of principal and different periods of time over which interest is accrued. Have students apply this information to the interest rates on the chart. Include problems that require solving for total interest earned and others that require solving for total amount in an account at the end of an interest-earning period.

Area Coins

The following are outlines of coins from different "areas" of the world. Ask students to find the area of each coin based on the information provided.

United States

area = _____

Mexico 

area = _____

Canada

area = _____

You may wish to have students bring in outlines of coins they have at home to use for additional area problems.